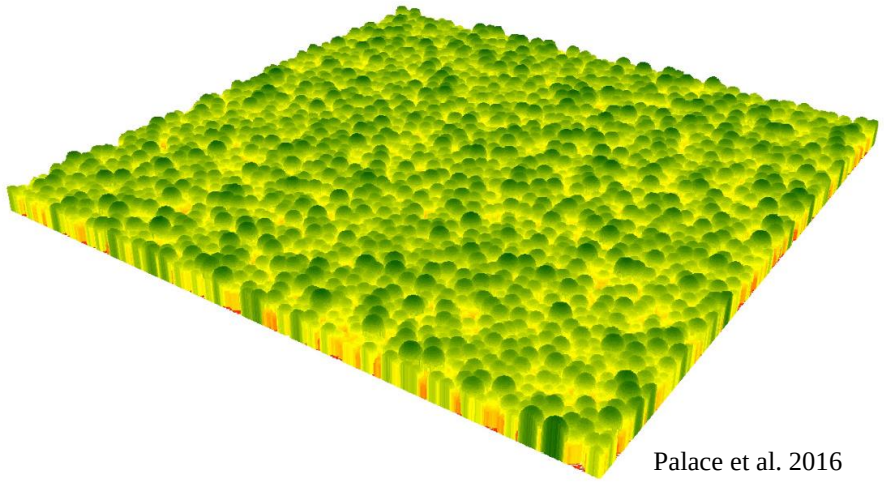
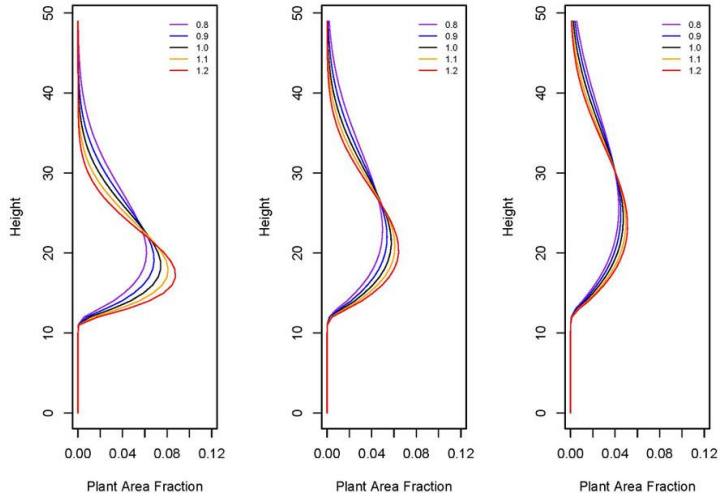
Boreal Forest Model Validation with Discrete LiDAR and Spectral-Induced Fluorescence Remotely Sensed Data



Palace et al. 2016

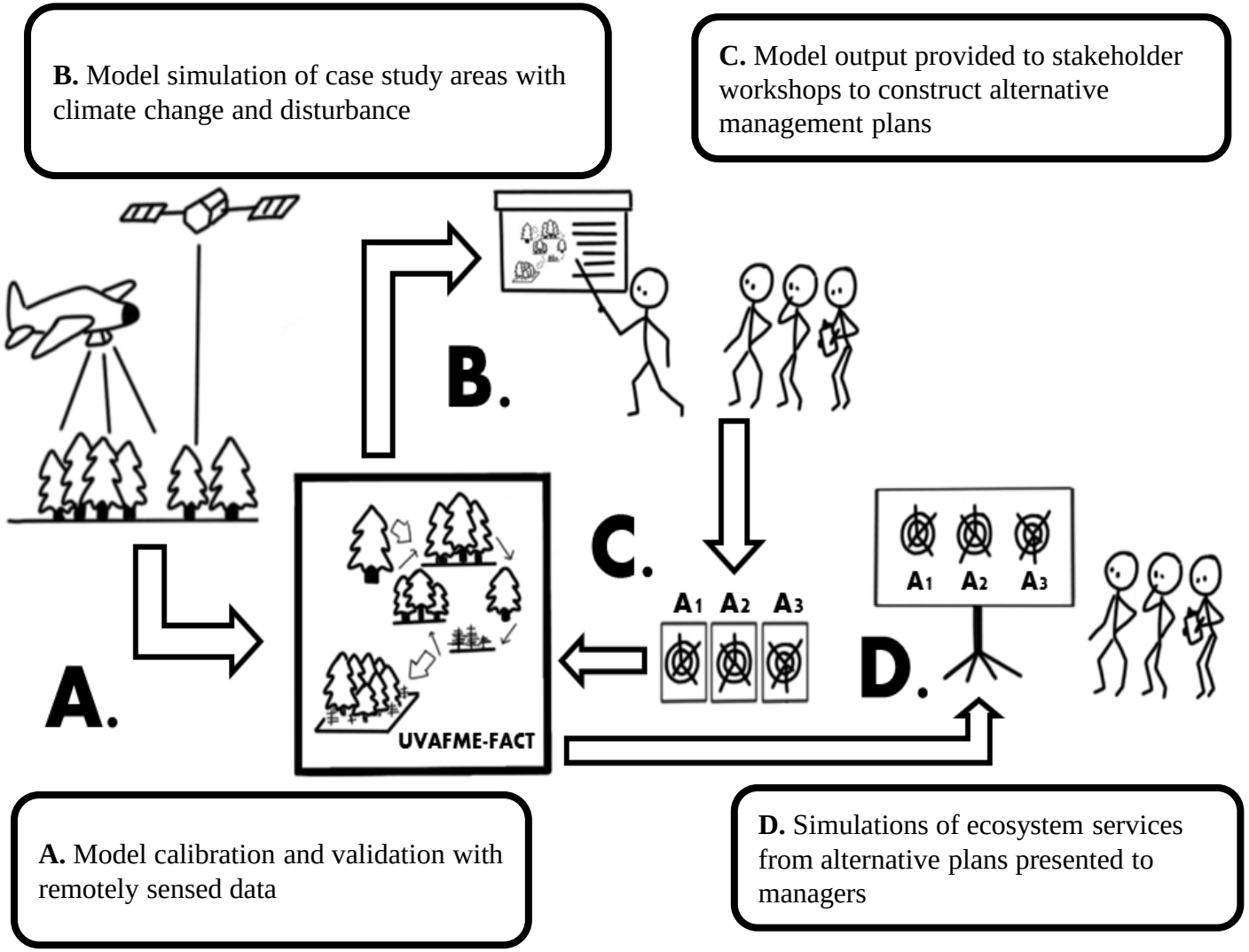


David Lutz — Dartmouth College
Manuel Lerdau, Xi Yang, Hank Shugart — University of Virginia
Michael Palace, Franklin Sullivan — University of New Hampshire
Adrianna Foster — Northern Arizona University

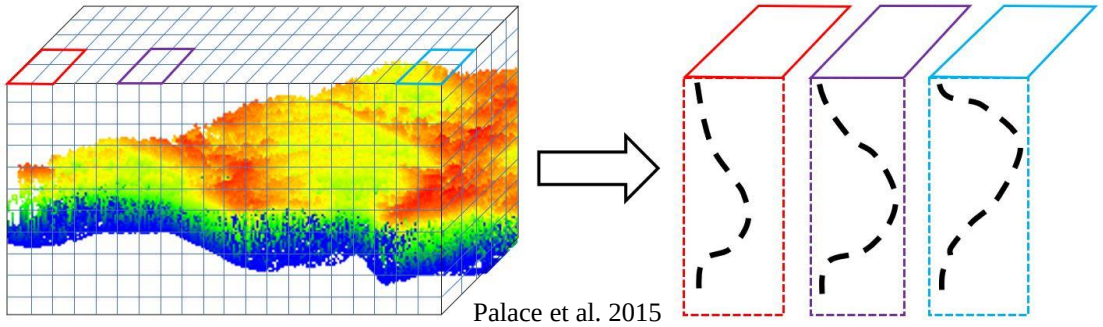
Main Objectives

1) Simulate the dynamics of forest patterns and processes under future climate and disturbance scenarios using an individual-based forest gap model

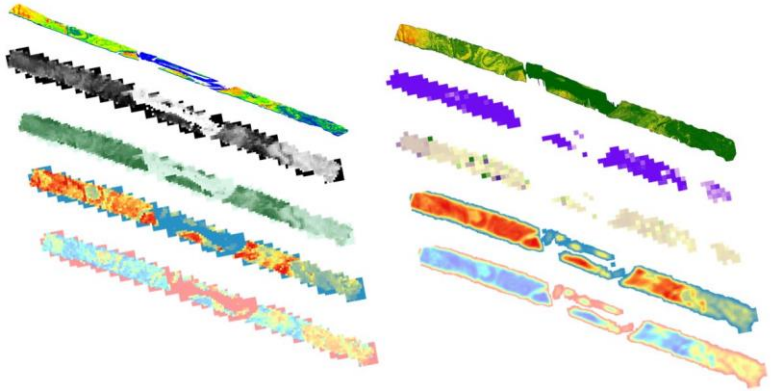
2) Assess tradeoffs in the delivery of ecosystem services under a set of stakeholder-informed management strategies at each study site using coupled forest-gap and ecological economics model output.



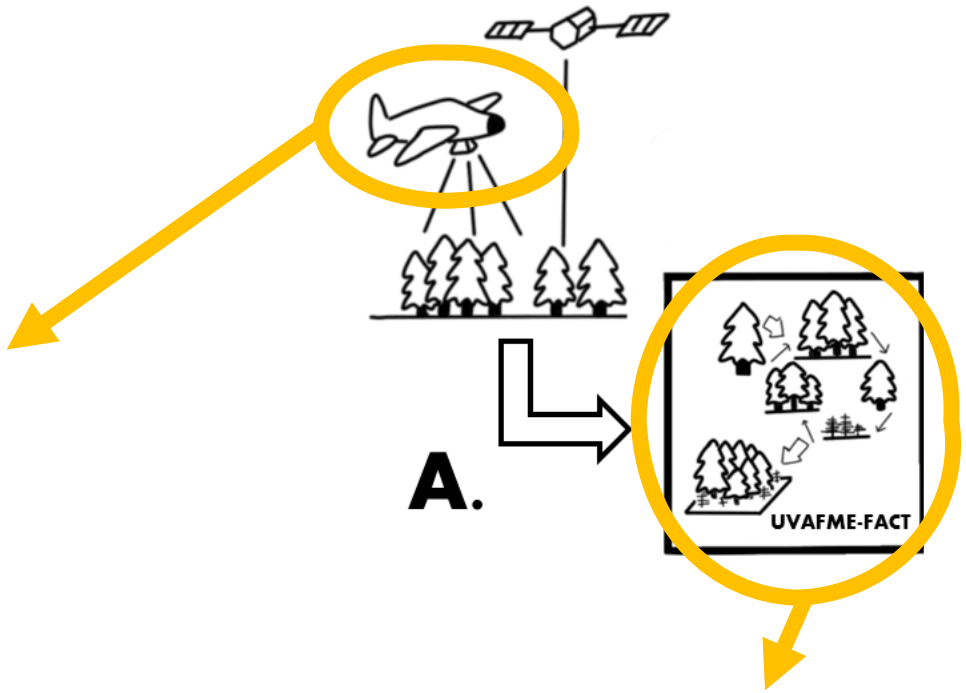
Objective 1 Updates: LiDAR



Voxel representation of LiDAR point clouds from G-LiHT overpass used to construct vegetation profiles.



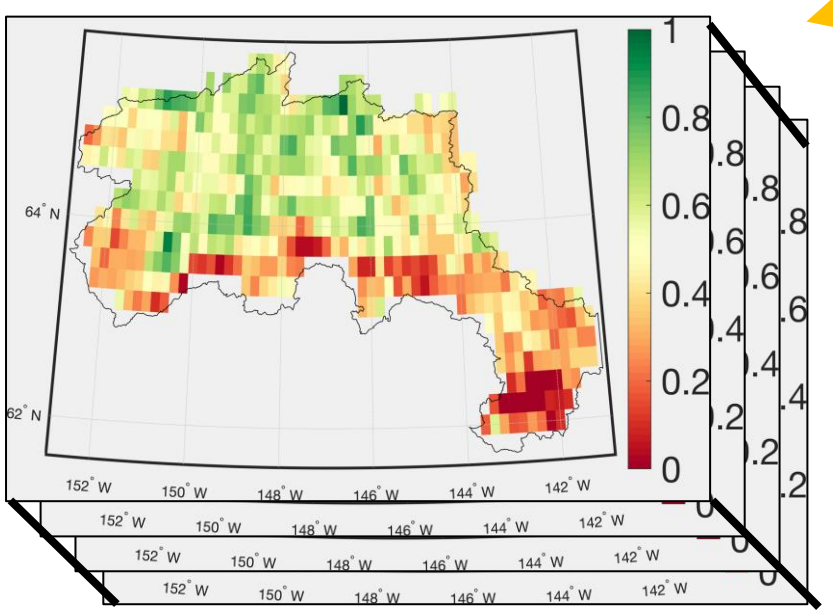
Vertical profile metrics (left) and canopy surface metrics (right) constructed for 50-meter windows.



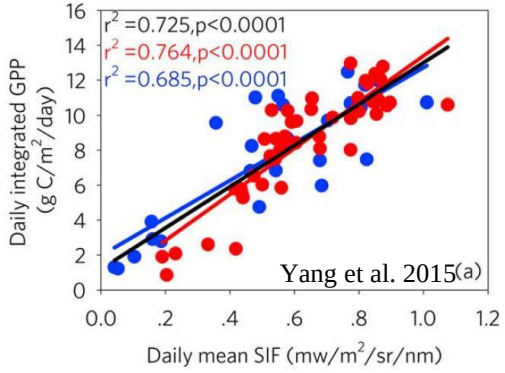
siteID	Lorey's	Max Height	Stem	LAI
268269	12.1695	18.0706	4025	4.548024
268270	12.5363	18.5691	3945.8	4.990756
268271	17.2579	20.9545	6734.6	5.615886
268272	17.5083	22.0131	8031.2	4.865901
269295	11.1172	16.5482	3808.8	4.100912
269296	18.2341	21.6056	6109.1	5.780267
269297	16.5888	20.9171	6958.7	5.681715
269298	17.9806	22.4387	3118.9	6.274076
270321	17.4375	21.2093	6837.8	5.851297
270322	17.6912	21.9926	6621.5	5.701663

Ten coincident sites with UVAFME in Foster *et al.*

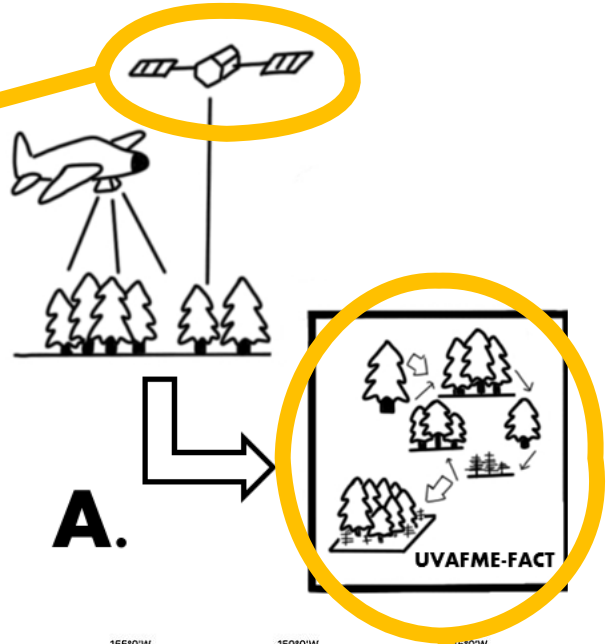
Objective 1 Updates: SIF

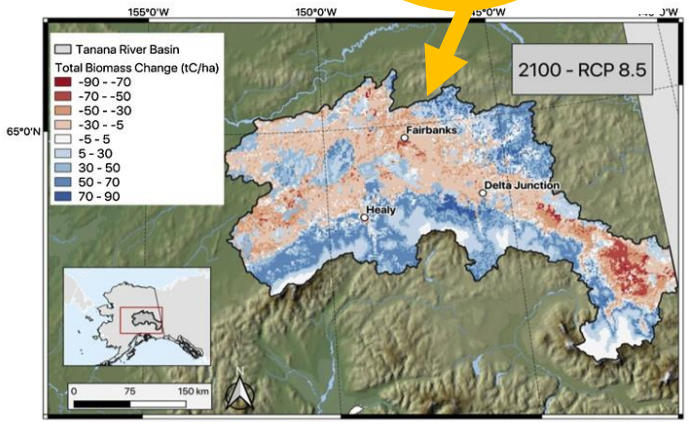


Oversampled TROPOMI SIF monthly mean data collected over TVSF



Established SIF/GPP relationships convert to GPP at sites



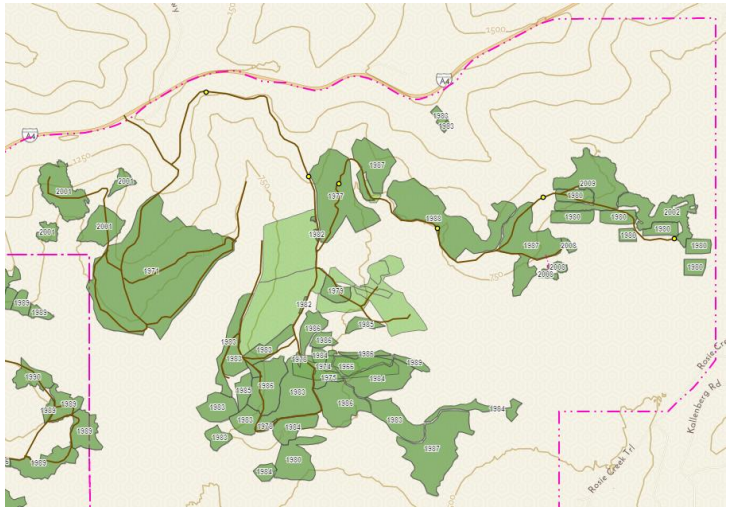


Re-run of Foster *et al.* sites using GPP-extension in Wang *et al.* 2017 for comparison

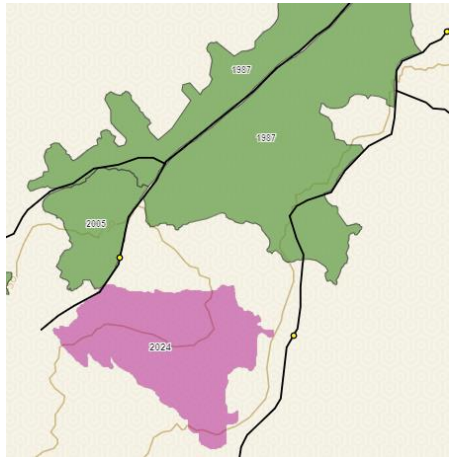
Objective 2 Updates: TVSF CAC

The Citizens Advisory Committee for the Tanana Valley State Forest are main collaborators for our first study site.

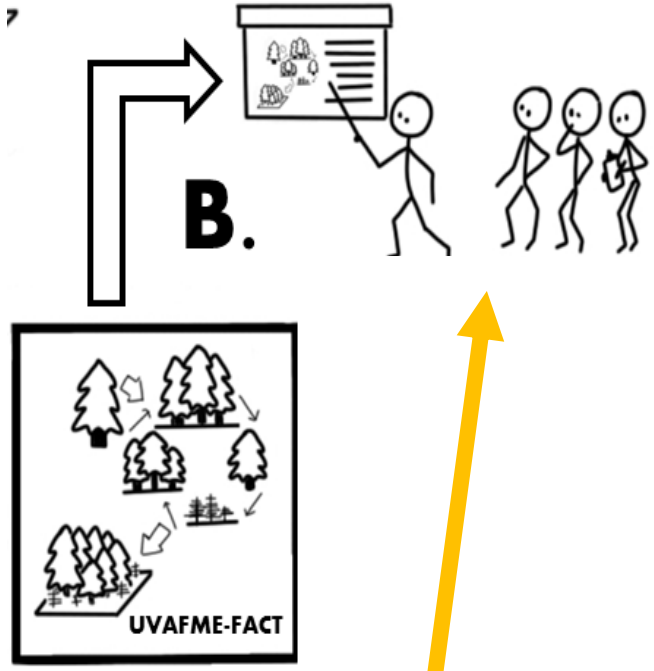
We planned to meet with representatives from the CAC in May in conjunction with this meeting in Fairbanks. Obviously, this will need to be rescheduled.



A new data stream from the DOF provides stand timber sales and cut year.



This includes future scheduled harvest!



We have participated in the May annual meetings (remotely) in 2019 and 2020 and our workshop with them will take place in May of 2021.

Future Directions

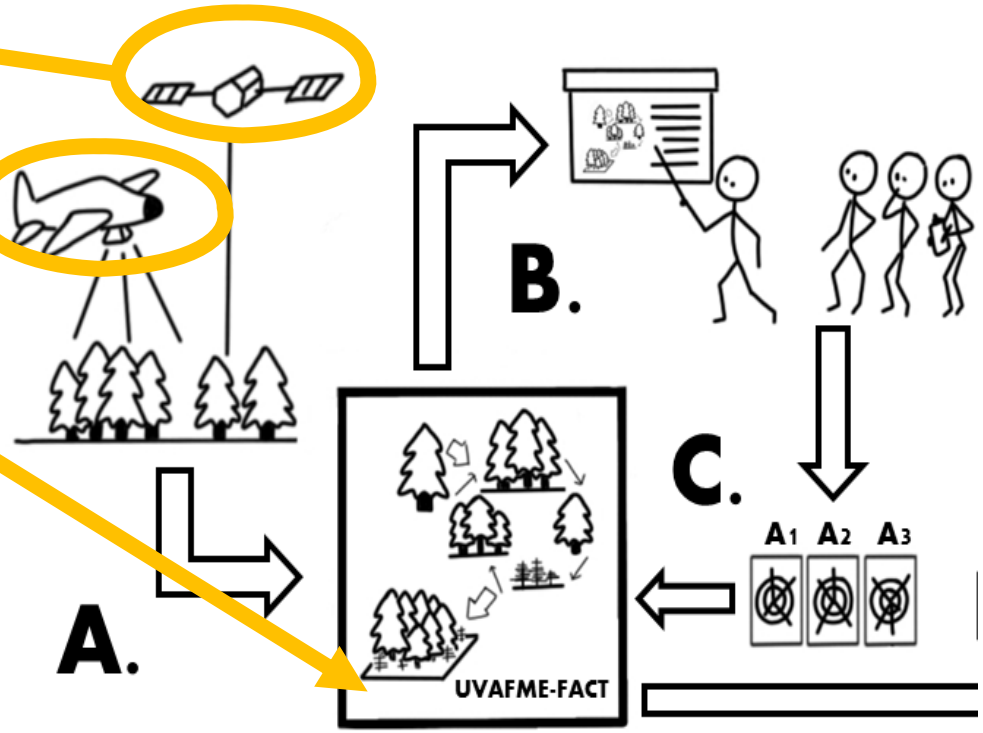
1.) Complete TVSF-wide validation with TROPOMI SIF

2.) Complete validation of model runs with G-LiHT data

3.) Modify mortality sub-routine to accept harvest parameter inputs and generate timber product outputs.

4.) Simulation of 20-year forest management plan at TVSF in preparation for workshop in May 2021.

5.) Conceptual Framework manuscript on the integration of remote sensing, modeling, and calculating flows of ecosystem services.



Thank You!

Dynamic Modeling of Forest Ecosystem Processes and Services in North American Boreal Forests

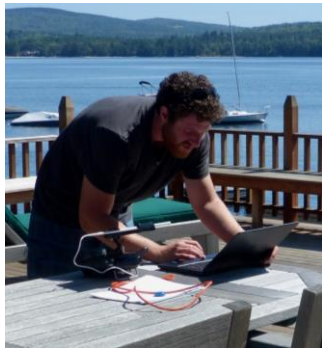
Award #: 80NSSC19M0118

David Lutz, Dartmouth

Manuel Lerdau, UVA

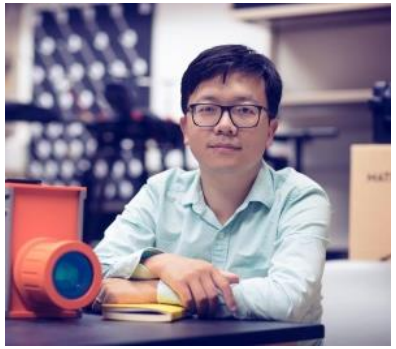
Hank Shugart, UVA

Adrianna Foster, NAU



Franklin Sullivan, UNH

Michael Palace, UNH



Xi Yang, UVA

Contact info:

David.a.lutz@dartmouth.edu
1-603-646-4009

University of Virginia

University of New Hampshire
College of Engineering and Physical Sciences

ABoVE
ARCTIC – BOREAL VULNERABILITY EXPERIMENT